CLAIMS

1. A transparent substrate, especially made of glass, provided with a thin-film stack comprising a plurality of functional layers, characterized in that said thin-film stack comprises at least three silver-based functional layers, in that said stack has a resistance $R_{\square} < 1.5\ \Omega$ per square and in that said substrate may undergo at least one transformation operation involving a heat treatment at a temperature of at least 500°C.

2. The transparent substrate as claimed in claim 1, characterized in that it has a light transmission $T_L \geq 70\ \%$.

3. The transparent substrate as claimed in claim 1, characterized in that it has a light transmission $T_L \geq 40\%$ and in that when it is associated with at least one other substrate to form a glazing assembly, this glazing assembly has a selectivity ≥ 2.

4. The transparent substrate as claimed in claim 1, characterized in that it has a light transmission $T_L \geq 40\%$ and a resistance $R_{\square} \leq 1.1\ \Omega$ per square.

5. The transparent substrate as claimed in any one of the preceding claims, characterized in that it comprises at least four silver-based functional layers.

6. The transparent substrate as claimed in any one of the preceding claims, characterized in that the total thickness of the silver-based functional layers is greater than or equal to 25 nm and is preferably between 35 and 50 nm when the stack comprises three functional layers and between 28 and 64 nm when the stack comprises at least four functional layers.

7. The transparent substrate as claimed in any one of the preceding claims, characterized in that it comprises at least three identical features of functional layers, each functional layer being associated in each functional feature with at least one subjacent and/or superjacent layer.

8. The transparent substrate as claimed in any one of the preceding claims, characterized in that at least one functional layer, and preferably each functional layer, is located between at least one lower dielectric layer and one upper dielectric layer, said dielectric layers preferably being based on ZnO, optionally doped with aluminum.

9. The transparent substrate as claimed in any one of the preceding claims, characterized in that at least one functional layer, and preferably each functional layer, comprises an upper layer based on Si_3N_4, AlN or based on a mixture of the two.

10. The transparent substrate as claimed in any one of the preceding claims, characterized in that it is directly coated with a layer based on Si_3N_4, AlN or based on a mixture of the two.

11. The transparent substrate as claimed in any one of the preceding claims, characterized in that, in at least one functional feature, and preferably in each functional feature, an upper absorbent metal layer, preferably based on Ti, is located between the silver-based functional layer and at least one upper dielectric layer.

12. The transparent substrate as claimed in any one of claims 1 to 10, characterized in that, in at least one functional feature, and preferably in each functional feature, a lower absorbent metal layer, preferably based on Ti, is located between at least one lower dielectric layer and the silver-based functional layer.

13. The transparent substrate as claimed in any one of the preceding claims, characterized in that at least one functional feature, and preferably each functional feature, has the following structure: ZnO/Ag/...ZnO/Si_3N_4 and preferably the following structure: ZnO/Ag/Ti/ZnO/Si_3N_4.

14. The transparent substrate as claimed in the preceding claim, characterized in that the thicknesses of the constituent layers of said feature in the case of the three-layer stack are:

ZnO / Ag / ...ZnO / Si_3N_4 and preferably ZnO/ Ag/ Ti/ ZnO/Si_3N_4

5 to 15/10 to 17/...5 to 15/25 to 65 nm and preferably 5 to 15/10 to 17/ 0.2 to 3/5 to 15/25 to 65 nm.

15. The transparent substrate as claimed in claim 13, characterized in that the thicknesses of the constituent layers of said feature in the case of the four-layer stack are:

ZnO / Ag / ...ZnO / Si_3N_4 and preferably ZnO/ Ag/ Ti/ ZnO/Si_3N_4

5 to 15/7 to 15/...5 to 15/23 to 65 nm and preferably 5 to 15/7 to 15/ 0.2 to 3/5 to 15/23 to 65 nm.

16. A process for manufacturing a transparent substrate, especially made of glass, provided with a thin-film stack comprising a plurality of functional layers, characterized in that at least three silver-based functional layers are deposited on said substrate, in that said stack has a resistance $R_\square < 1.5\ \Omega$ per square and in that said substrate may undergo at least one transformation operation involving a heat treatment at a temperature of at least 500°C.

17. The process as claimed in claim 16, characterized in that at least four silver-based functional layers are deposited on said substrate.

18. The process as claimed in claim 16 or claim 17, characterized in that the total thickness of the silver-based functional layers deposited is greater than or equal to 25 nm and is preferably between 35 and 50 nm when the stack comprises three functional layers and between 28 and 64 nm when the stack comprises at least four functional layers.

19. The process as claimed in one of claims 16 to 18, characterized in that at least three identical features of functional layers are deposited on said substrate, each functional layer being associated in each functional feature with at least one subjacent and/or superjacent layer.

20. The process as claimed in any one of claims 16 to 19, characterized in that, for at least one functional layer, and preferably for each functional layer, at least one lower dielectric layer is deposited beneath said functional layer and an upper dielectric layer is deposited on said functional layer, said dielectric layers being preferably based on ZnO, optionally doped with aluminum.

21. The process as claimed in any one of claims 16 to 20, characterized in that an upper layer based on Si_3N_4, AlN or based on a mixture of the two is deposited on top of at least one functional layer, and preferably on top of each functional layer.

22. The process as claimed in any one of claims 16 to 21, characterized in that said substrate is directly coated with a layer based on Si_3N_4, AlN or based on a mixture of the two.

23. The process as claimed in any one of claims 16 to 22, characterized in that, in at least one functional feature, and preferably in each functional feature, an upper absorbent metal layer, preferably based on Ti, is deposited on top of the silver-based functional layer and beneath at least one upper dielectric layer.

24. The process as claimed in any one of claims 16 to 22, characterized in that, in at least one functional feature, and preferably in each functional feature, a lower absorbent metal layer, preferably based on Ti, is deposited on top of at least one lower dielectric layer and beneath the silver-based functional layer.

25. The process as claimed in any one of claims 16 to 24, characterized in that at least one functional feature deposited, and preferably each functional feature deposited, has the following structure: ZnO/Ag/...ZnO/Si_3N_4 and preferably the following structure: ZnO/Ag/Ti/ZnO/Si_3N_4.

26. The process as claimed in the preceding claim, characterized in that the thicknesses of the constituent layers of said feature in the case of the three-layer stack are:

ZnO / Ag /... ZnO / Si_3N_4 and preferably ZnO/ Ag/ Ti/ ZnO/Si_3N_4

5 to 15/10 to 17/... 5 to 15/25 to 65 nm and preferably 5 to 15/10 to 17/ 0.2 to 3/5 to 15/25 to 65 nm.

27. The process as claimed in claim 25, characterized in that the thicknesses of the constituent layers of said feature in the case of the four-layer stack are:

ZnO / Ag /... ZnO / Si_3N_4 and preferably ZnO/ Ag/ Ti/ ZnO/Si_3N_4

5 to 15/7 to 15/ ...5 to 15/23 to 65 nm and preferably 5 to 15/7 to 15/ 0.2 to 3/5 to 15/23 to 65 nm.

28. The process as claimed in any one of claims 16 to 27 characterized in that the functional features are deposited by passing said substrate several times through a single manufacturing device.

29. The process as claimed in the preceding claim, characterized in that when said stack comprises four silver-based functional layers, the features are deposited in pairs, by passing said substrate twice through a single manufacturing device.

30. The process as claimed in the preceding claim, characterized in that the thicknesses of the deposited layers are substantially identical during each of the two passes.

31. The process as claimed in any one of claims 16 to 30, characterized in that when said substrate undergoes a transformation operation involving a heat treatment at a temperature of at least 500°C, its resistance $R_{\square}$ is reduced by at least 10%, or even at least 15%.

32. Glazing for thermal control and/or electromagnetic shielding and/or heating, which incorporates at least one substrate as claimed in any one of claims 1 to 15.

33. The use of the substrate as claimed in any one of claims 1 to 15, for producing, alternatively or cumulatively, thermal control and/or electromagnetic shielding and/or heating.